

Application No. 09/539,346  
Amendment dated September 22, 2003  
Reply to Office Action of June 20, 2003

**Amendments to the Claims**

This listing of claims will replace all prior versions, and listing, of claims in the application:

**Listing of Claims:**

1. (Currently amended) An apparatus having an x-ray head adjustable in at least three mutually transverse axes for directing ~~x-rays~~ x-ray energy from different positions toward a part and sensing the energy from the part, the apparatus comprising:
  - at least one detector for sensing the x-ray energy;
  - a frame for supporting the x-ray head and the detector;
  - an x-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in an x-axis fore and aft direction;
  - a y-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a y-axis lateral direction; and
  - a z-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a z-axis vertical direction; and
  - at least one fine adjustment mount of the frame operably connected to the head and detector for providing finer adjustments of the head and detector in one of the x, y and z directions than the corresponding one of the x, y and z-axis adjustment mounts to allow the head and detector to be moved rapidly via rough adjustments provided by the one adjustment mount, and to move more precisely via fine adjustments provided by the one fine adjustment mount.
2. (Original) The apparatus of claim 1 wherein the frame includes a fixture portion adapted to removably attach the frame to the part to allow the x-ray head to be used on parts in the field.

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3. (Original) The apparatus of claim 2 wherein the fixture portion includes adjustable clamps for removably attaching the frame to different sizes of cables with the adjustable clamps comprising the y-axis adjustment mount to allow the head to be located at different positions along the length of the cable.
4. (Original) The apparatus of claim 1 wherein the x, y, and z adjustment mounts include linear drives for linearly adjusting the head in three mutually perpendicular directions with the x and y adjustment mounts allowing the head to direct x-rays to a predetermined region on the part and the z-adjustment mount allowing the focal distance of the head from the part to adjusted.
5. (Original) The apparatus of claim 1 wherein the frame and x, y, and z adjustment mounts are integrated in a portable x-ray diffraction unit for being transported to different part sites, and
  - a stand distinct from the portable unit for supporting the unit at a desired part site.
6. (Original) The apparatus of claim 5 wherein the unit and the stand have an adjustable attachment therebetween to allow the unit and stand to be shifted to different positions relative to each other.
7. (Original) The apparatus of claim 5 wherein the head includes detectors for sensing the x-rays off from the part, and
  - a controller connected to the head for receiving signals from the detectors and including circuitry adapted to generate maps of a strength related characteristic of the part at the part site with the strength related characteristic being based on the received signals.

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8. (Rewritten) The apparatus of claim 1 An apparatus having an x-ray head adjustable in at least three mutually transverse axes for directing x-ray energy from different positions toward a part and sensing the energy from the part, the apparatus comprising:
  - at least one detector for sensing the x-ray energy;
  - a frame for supporting the x-ray head and the detector;
  - an x-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in an x-axis fore and aft direction;
  - a y-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a y-axis lateral direction; and
  - a z-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a z-axis vertical direction and at least one fine adjustment mount of the frame for providing finer adjustments of the head and detector in one of the x, y and z directions than the corresponding one of the x, y and z-axis adjustment mounts to allow the head and detector to be moved rapidly via rough adjustments provided by the one adjustment mount, and to move more precisely via fine adjustments provided by the one fine adjustment.

wherein the head includes an elongate housing having a longitudinal axis, and the frame includes an r-axis adjustment mount operably connected to the head for adjusting the head in an r-axis rotary direction about the housing axis to allow the head to direct x-rays at contoured parts.
9. (Original) The apparatus of claim 8 wherein the frame includes a phi-axis adjustment mount operably connected to the head for the adjusting the head in a phi-axis rotary direction transverse to the r-axis rotary direction.
10. (Original) The apparatus of claim 9 wherein the phi-axis adjustment mount is disposed forwardly in x-axis direction from the z-axis adjustment mount.

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11. (Rewritten) The apparatus of claim 1 including An apparatus having an x-ray head adjustable in at least three mutually transverse axes for directing x-ray energy from different positions toward a part and sensing the energy from the part, the apparatus comprising:

at least one detector for sensing the x-ray energy;

a frame for supporting the x-ray head and the detector;

an x-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in an x-axis fore and aft direction;

a y-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a y-axis lateral direction; and

a z-axis adjustment mount of the frame operably connected to the head and detector for adjusting the head and detector in a z-axis vertical direction and at least one fine adjustment mount of the frame for providing finer adjustments of the head and detector in one of the x, y and z directions than the corresponding one of the x, y and z-axis adjustment mounts to allow the head and detector to be moved rapidly via rough adjustments provided by the one adjustment mount, and to move more precisely via fine adjustments provided by the one fine adjustment,

a touch sensor which is shifted into engagement with the part with the head a predetermined distance from the part in the z-axis direction, and

a controller signaled by the touch sensor for repeatable locating of the head at the predetermined distance from the part after use of the sensor.

12. (Original) The apparatus of claim 11 wherein the controller includes a teach mode to allow an operator to shift the touch sensor into engagement with the part at various locations thereon by shifting of the head via the adjustment mounts for mapping part contour so that the head precisely directs x-rays toward the part at the various locations along its contour.

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13. (Original) The apparatus of claim 12 wherein the head includes an elongate housing having a longitudinal axis, and the frame includes an r-axis adjustment mount operably connected to the head for adjusting the head in an r-axis rotary direction about the housing axis to allow the head to focus x-rays at parts having contours including curved surfaces without moving the part.

14. (Original) An apparatus for directing x-rays at parts with curved surfaces, the apparatus comprising:

an x-ray head having an elongate housing including a longitudinal axis thereof,  
a frame for supporting the x-ray head; and

an adjustment mount of the frame which allows the head to undergo rotary movement about the longitudinal axis thereof to substantially keep the head at a predetermined distance from a curved surface of a part at which x-rays are directed at various positions along the part curved surface.

15. (Original) The apparatus of claim 14 including a plurality of other adjustment mounts for moving the head in a plurality of different directions to allow the head to move in a path that substantially matches the contour along the part defined by the different positions at which x-rays are to be directed.

16-28. (Cancelled)

29. (New) The apparatus of claim 1 wherein each of the x, y and z adjustment mounts comprise rough adjustment mounts, and the at least one fine adjustment mount comprises x, y and z fine adjustment mounts.